

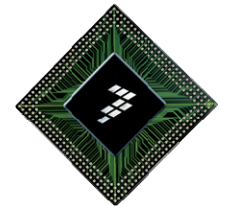


Freescal Technology Forum

Collaboration. Innovation. Inspiration.

August, 2009

ColdFire® MCF51CN128 and the Tower System

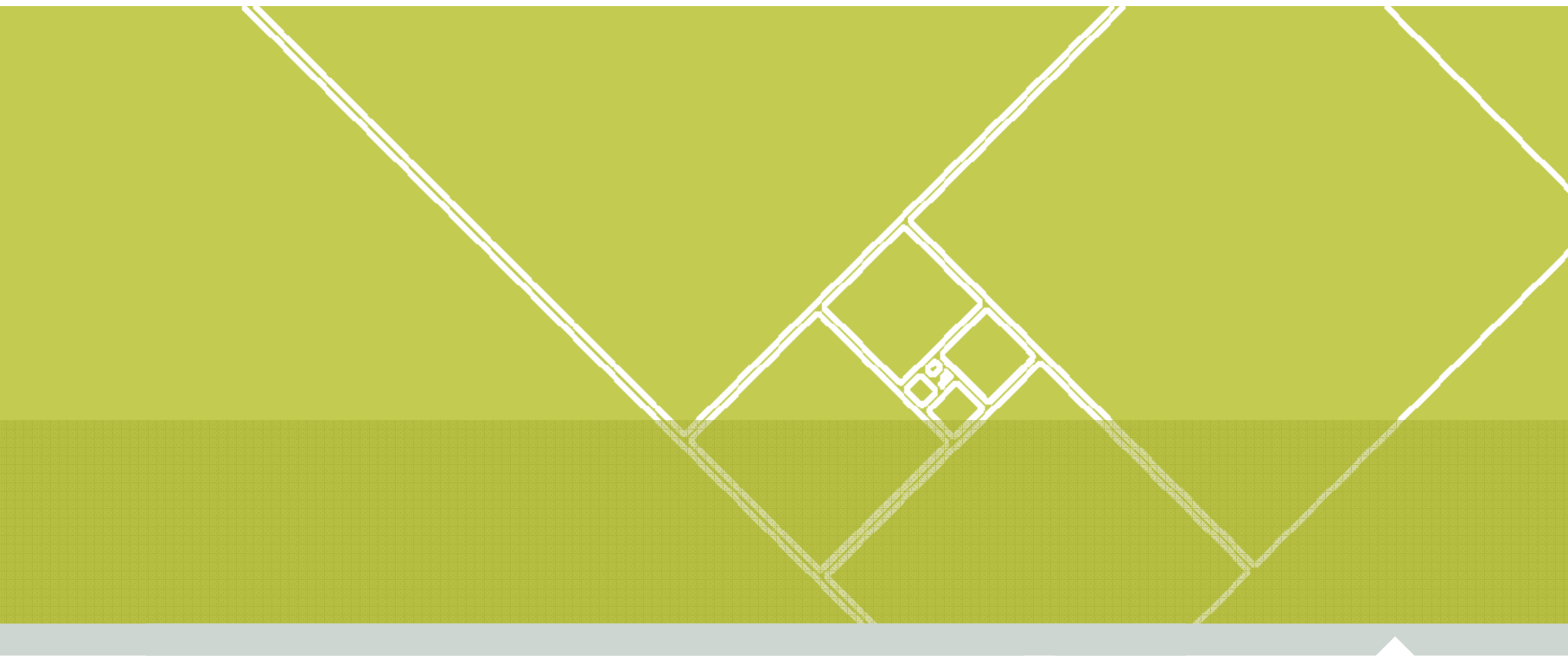


Wang Hao
Application Engineer

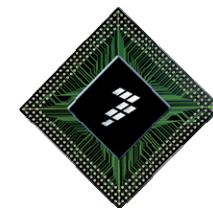
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- ▶ Introduction on MCF51CN128
 - Features – Minibus, Ethernet
 - Typical use cases
 - Ultimate Ethernet solution with MQX and Tower System
- ▶ Introduction on concept of tower system
- ▶ MCF51CN128 out-of-box demos on tower board



Introduction on MCF51CN128



Core

68K/ColdFire® V1 Core

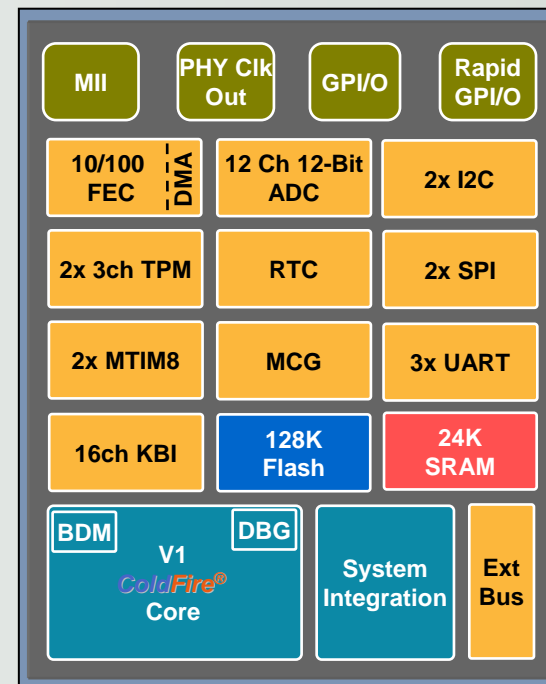
- Up to 46 Dhrystone 2.1 MIPS @ 50 MHz
- **Mini Flexbus support** up to 1MB external memory (80LQFP, reduced for 64LQFP) support 2 Devices

Memory

- 128K bytes flash
- **24K bytes SRAM**

Features

- **Ethernet:**
 - **10/100 FEC** – Fast Ethernet Controller with DMA
 - MII Interface with **Output Clock for PHY**
 - Support Half/Full Duplex
- **Low power mode** – Ethernet operation supported at 3V and above
- **Ultra-small (7x7mm) 48-pin package**
- **12-Ch, 12-Bit ADC**
- **3x UARTs** (2 on 48 pin, 3 on 64/80 pin)
- **2x SPI**
- **2x I²C bus interface**
- **Real Time Counter**
- **Up to 70 General-Purpose I/O**
- **System Integration (PLL, SW Watchdog)**
- **Single Voltage Supply 1.8-3.6V**



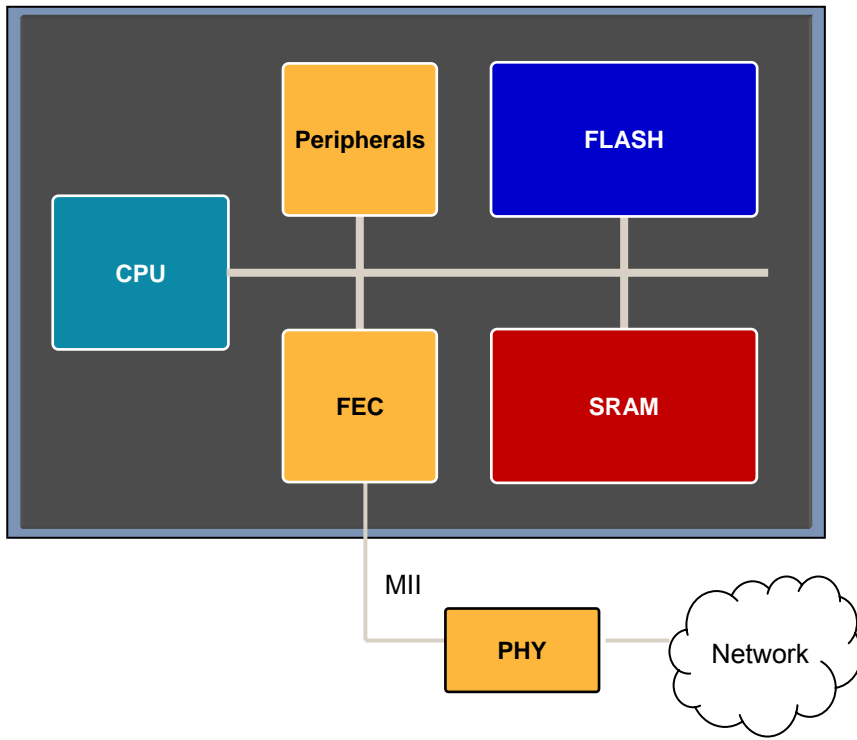
Availability

Temperature range: -40°C to +85°C

Available packages: 80 LQFP, 64 LQFP and 48 QFN

10K pricing starts at USD \$2.99 MSRP

Fast Ethernet Controller



Ethernet Media Access controller (MAC)

- 10/100 Mbps Ethernet/IEEE 802.3 networks
- IEEE 802.3 full duplex flow control
- Supports three MAC-PHY interfaces:
10Mbps MII, 100Mbps MII and 10Mbps only 7-wire interface
- Choose an External PHY based on the system requirements
 - Lowest cost
 - Highest reliability
 - Optical
 - Added functionality (Time stamping)

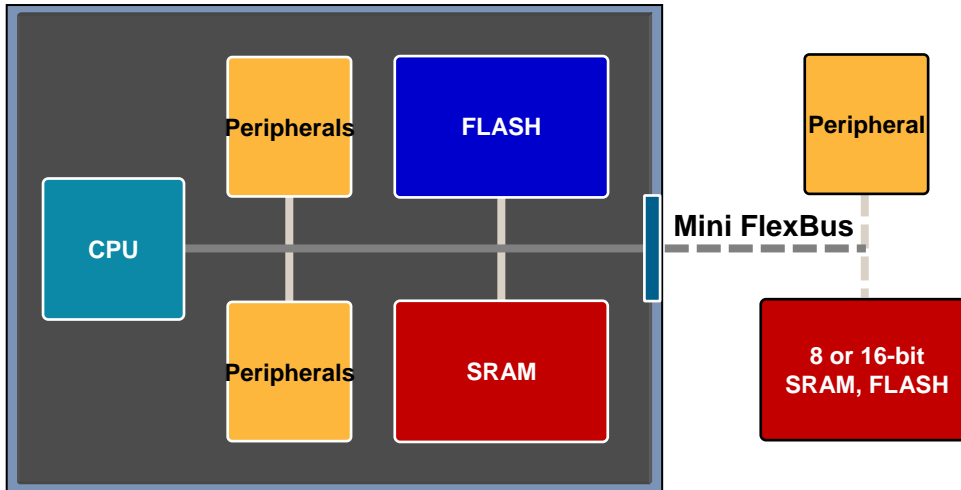
Introducing the Mini-FlexBus

Mini-FlexBus

- Small but functional External Bus Interface for MCUs
- Based on FlexBus
- Offers better performance than using serial memories
- 2 Mbyte Addressable memory

Signal(s)	Description	Pins
D[31:24]/AD[31:24]	dedicated data bus or multiplexed address/data bus	8
A[19:0]/AD[19:0]	dedicated address bus or multiplexed address/data bus	20
$\overline{\text{CS0}}$	chip select 0	1
$\text{ALE}/\overline{\text{CS1}}$	address latch enable/chip select 1	1
$\overline{\text{OE}}$	output enable	1
$\text{R}/\overline{\text{W}}$	read/write	1

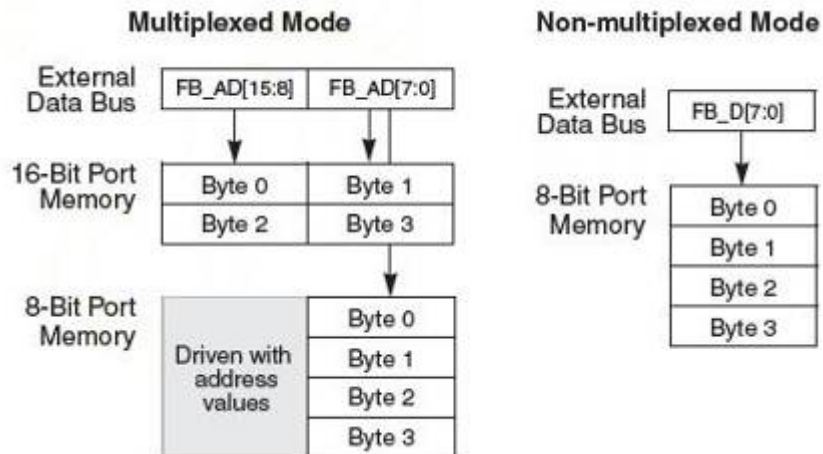
Microcontroller Expanded – Mini FlexBus



- ▶ Mini FlexBus offers two expansion modes:
 - Non multiplexed, 8-bit data and 20-bit address
 - Multiplexed, 8 or 16-bit data and 20-bit address
- ▶ When MCU is secured, code runs from internal flash only, else may also run from external memory
- ▶ On-chip SRAM holds most frequently used data, additional data may be stored in external memory
- ▶ External mini-bus interface can be used for additional memory, Peripherals (display controllers, extra serial interfaces, etc.), or FPGAs or CPLDs (any kind of customer-specific logic)

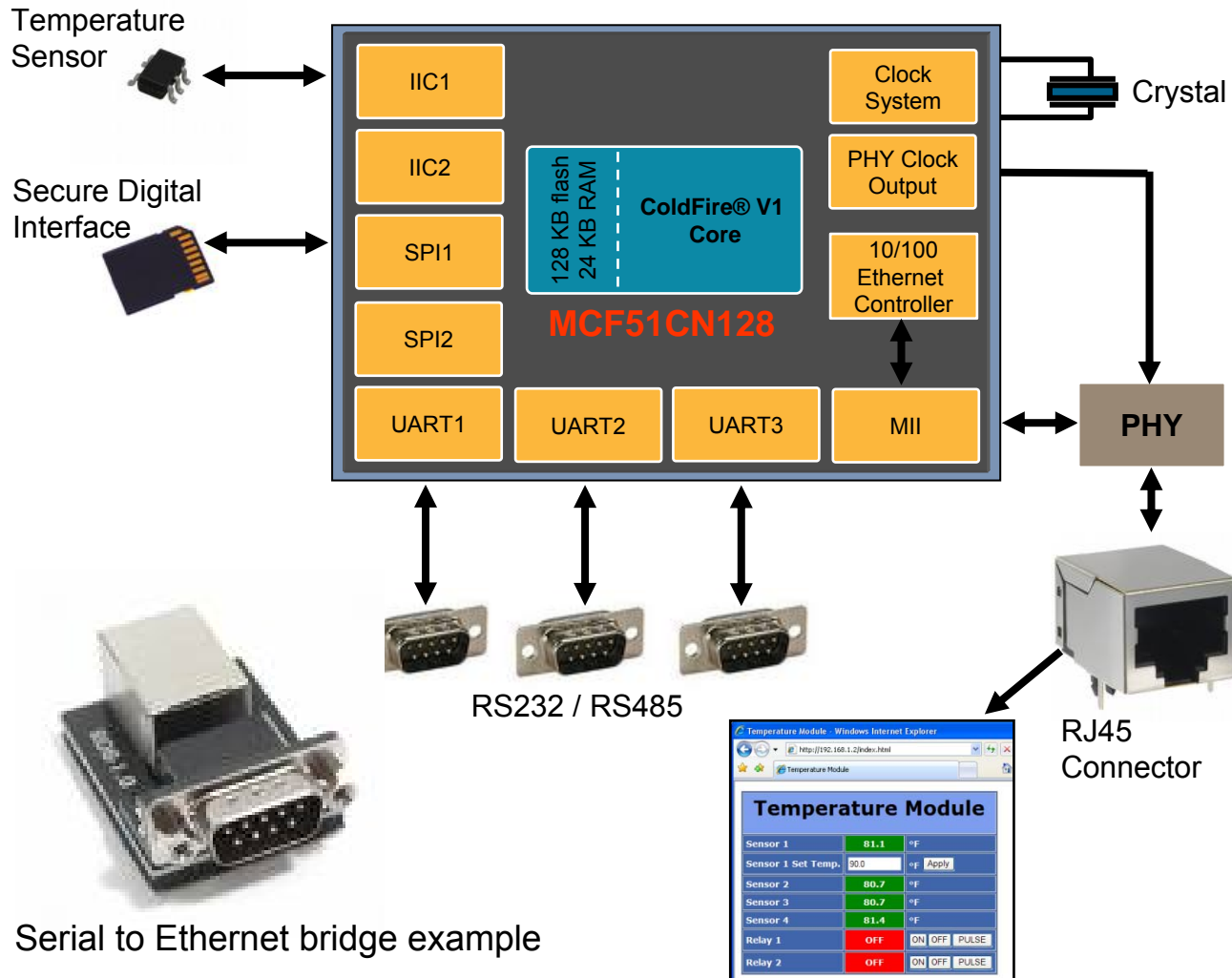
Mini-FlexBus

- 8-Bit or 16-Bit wide, Multiplexed or Non-Multiplexed Mode
- byte, word, longword, and 16-byte line-sized transfers
- Programmable setup & hold times
- Bus frequency at Fsys



Port Size & Phase		FB_AD		
		[19:16]	[15:8]	[7:0]
16-bit	Address phase	Address		
	Data phase	Address	Data	
8-bit	Address phase	Address		
	Data phase	Address		Data

Serial to Ethernet Bridge

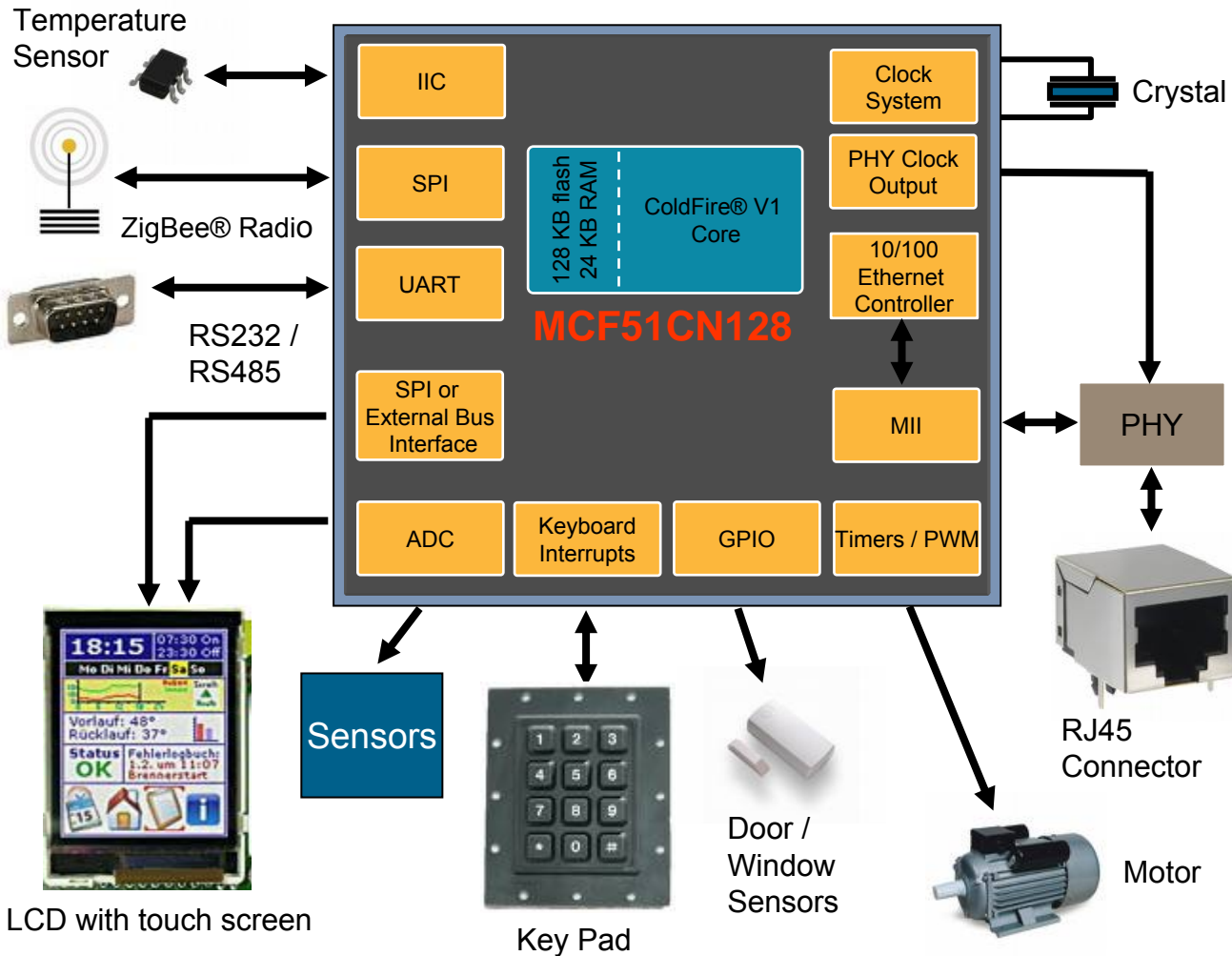


Serial to Ethernet bridge example

Key Benefits

- Connect traditional serial interfaces to any Ethernet network with multiple standard communication interfaces
- Suitable for applications requiring ultra-small footprints with 7x7mm² package
- Integrated PHY clock output helps eliminate additional PHY clock source and overall cost

Building Access Control



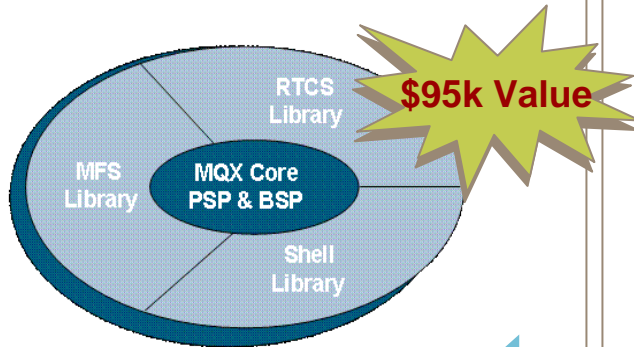
Key Benefits

- Suitable for applications requiring remote monitoring and control via 10/100 Base-T Ethernet
- Integrated external bus interface for driving an LCD or memory expansion
- Multiple pulse width modulation timer channels for motor control

The Ultimate Ethernet Solution

Freescalé MQX + MCF51CN

Complimentary Freescalé MQX Software



+



Starting at
\$2.99 USD

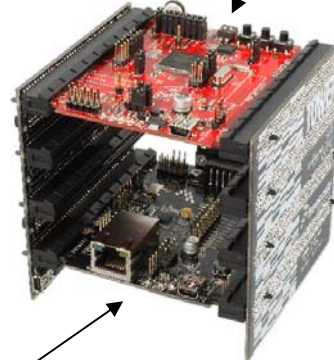
ColdFire V1 Ethernet MCU
Serial to Ethernet in Seconds

Complete solution for Serial to
Ethernet connectivity

Tower System

- Modular and Expandable
- Cost Effective

MCF51CN Microcontroller Module
\$39 USD



Serial Module
\$49 USD

Complete Kit
\$99 USD

Open source platform for
prototyping application development

Time to Market



Build a Tower Library

- Rapid prototyping
- Open source hardware
- Complimentary Freescalé MQX software

Saves months of prototyping –
now *and* in the future

The Complete Solution: Full Enablement Combined with MCF51CN

The Ultimate Ethernet Solution – ColdFire® V1 MCU featuring complimentary Freescale MQX™ Software with easy-to-use modular development hardware

Ethernet Connectivity Microcontrollers

- ▶ MCF51CN ColdFire V1 MCU featuring on-chip Ethernet and world-class tools to help enable Ethernet in your application quickly and easily.

Complimentary Freescale MQX RTOS

- ▶ With complimentary Freescale MQX™ software, CodeWarrior® tool suite and a world-class alliance network, the MCF51CN offers a comprehensive connectivity solution to help you develop quickly and easily.

Tower System

- ▶ Elevate your design to the next level. Our modular development platform saves you months of development time now and in the future through rapid prototyping and tool re-use.

Complimentary Freescale MQX RTOS, Ethernet Stack, file systems and more

Backed by Freescale

- Source code, rights to distribute and modify across the Freescale Portfolio

Benefits

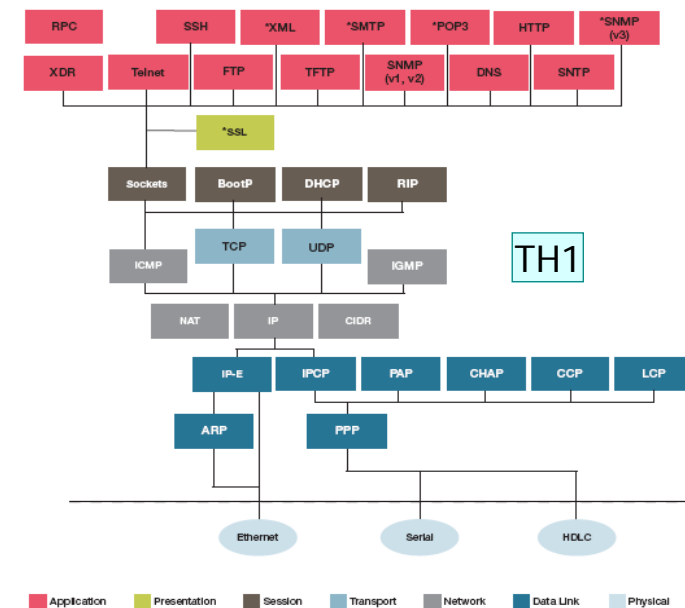
- Reuse of software
- Full production source code
- Developers keep their source modifications
- Small, configurable footprint
- Integrated communication suite (RTCS)

Value

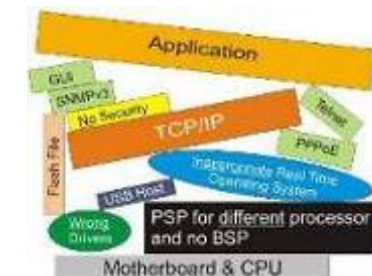
- Eliminates initial software investment hurdle
- \$95K worth of software from day one

Proven

- Market-proven software has been on Freescale processors for over 15 years
- Supporting millions of Fortune 500 companies' products



Past Customer Problem



The Solution



Enablement

- Retrieve time stamped status via e-mail alerts
- Allows telnet communication
- WebPages and view specific device data
- BSP: SCI, SPI, RTC, A/D, Mini-Flex bus and more
- File System (MFS) - SD Card and MRAM
- Altera CPLD + CF MQX interface
- Develop Low Power Mode

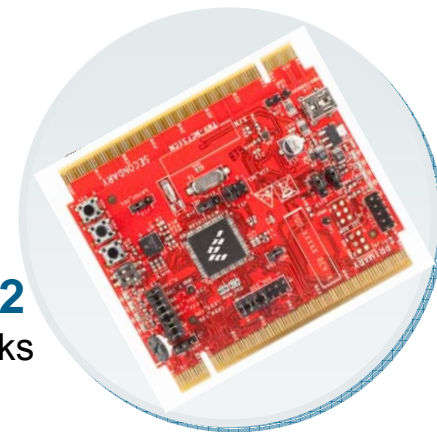
* Optional pre-integrated products

TH1 Ravel- these are reall hard to read. can you pick maybe 1 screenshot to showcase- and make it larger?
Tammy Harrison, 5/15/2009

Easy-to-Use Development Tools

► TWR-MCF51CN-KIT includes

- TWR-MCF51CN & TWR-SER modules
- TWR-ELEV modules & USB/Ethernet cables
- Quick Start Guide, lab tutorials and user manual
- Interactive DVD with documentation and training videos



► CodeWarrior Development Studio for Microcontrollers v6.2

- New project wizard creates a working project in as few as seven mouse clicks
- Advanced full-chip simulation enables hardware/software co-design
- Processor Expert tool shrinks board bring-up from weeks to days with automatic code generation of initialization code and drivers
- Free Special Edition with up to 64K code size [CWX-HXX-SE]



► Online training, webcast, technical documentation and application notes available at www.freescale.com/tower and www.freescale.com/coldfire

Available Software and Tools Support for MCF51CN

Subset of a comprehensive ecosystem of partners

Run-Time Software: RTOS, Stacks, File System



HQ Debugger/Emulators



Buy Direct



Cyclone MAX

Buy Direct



USB ColdFire Multilink :



IDE: Tools Compilers, Debuggers



GNU Tools

CodeWarrior

Security



Medical



MQX Support/ Design Service



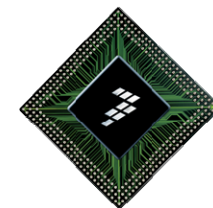
GUI Graphical



Flash Programming



Concept of Tower System



Freescale Tower System

- ▶ Low-cost modular development platform
- ▶ Can be purchased as individual modules or complete kit
- ▶ Microcontroller Modules:
 - MCF51CN
 - MCF5225X
 - *More to come...*
- ▶ Peripheral Modules:
 - 802.11b Wi-Fi
 - Serial
 - Memory
 - Graphical LCD
 - *More to come...*



The Tower System

Functional Elevator:

- Common serial and expansion bus signals
- Two 2x80 connectors on backside for easy signal access and side-mounting board (e.g. LCD module)
- Power regulation circuitry
- Standardized signal assignments

Board Connectors:

- Four card-edge connectors
- Uses PCI Express connectors (x16, 90mm/3.5" long, 164 pins)

Peripheral Module

(i.e. Serial, Memory, Graphical LCD)

MCU/MPU Module:

- Tower controller board
- Works stand-alone or in Tower system
- Features new Open Source BDM (OSBDM) for easy programming and debugging via miniB USB cable

Size: The Tower is approx. 3.5" H x 3.5" W x 3.5" D when fully assembled

Dummy Elevator:

- Future expansion for more serial interfaces and more complex MPU interfaces (e.g. RGB LCD, audio, enhanced Timer, etc.)
- "Dummy" shown with only GND connectivity. Used for structural integrity

Tower System Key Messages

Elevate your design to the next level with the Freescale Tower System.
Our modular development platform saves you months of development time now and in the future through rapid prototyping and tool re-use.

Modular and expandable

- ▶ Developing with the Tower System is easy with modular, reconfigurable hardware.

Saves months of development time

- ▶ Open source design files and standard, reusable modules reduce low-level design—giving you more time to focus on differentiated solutions.

Low Cost

- ▶ Flexible modular design helps you control tool costs, from simple concept testing to full product development.

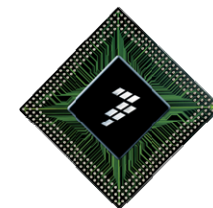
MCF51CN Development Modules and Kits



Complete Kits	CF V1 Ethernet Kit
Part Number	TWR-MCF51CN-KIT
Contents of Kit (reference part # below)	<ul style="list-style-type: none"> • TWR-MCF51CN • TWR-SER • TWR-ELEV
Resale Price	\$ 99.00

Individual Modules	CF V1 Ethernet	Serial - Ethernet, USB, RS232/485, CAN	Elevator Boards
Part Number	TWR-MCF51CN	TWR-SER	TWR-ELEV
Contents of case	<ul style="list-style-type: none"> •MCF51CN module •1 USB cable •DVD •Lab sheet •Quick Start Guide 	<ul style="list-style-type: none"> •Serial module •1 Ethernet Cable •1 USB Cable •User Manual (TWR-SER) 	<ul style="list-style-type: none"> •Two elevator boards
Resale Price	\$ 39.00	\$ 49.00	\$ 29.00

MCF51CN128 Out-of-Box Demos



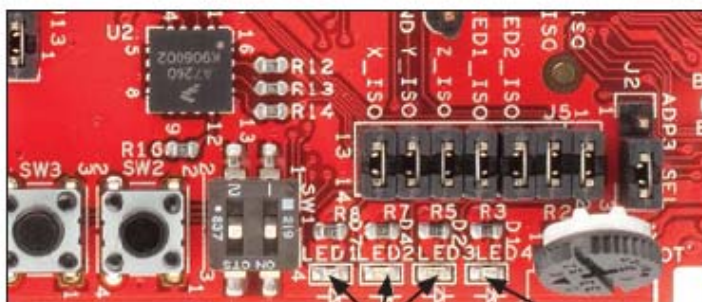
Door Security System Demos

- ▶ Telnet security demo
- ▶ Web server security demo
- ▶ Email security demo

- ▶ Serial to Ethernet bridge demo

Security telnet demo

- ▶ Assemble tower system
- ▶ Run the security telnet demo
- ▶ Run telnet 169.254.3.3 in command window
- ▶ Try press SW2, SW3, tilt board and tune potentiometer
- ▶ Display logs



Movement Button Press

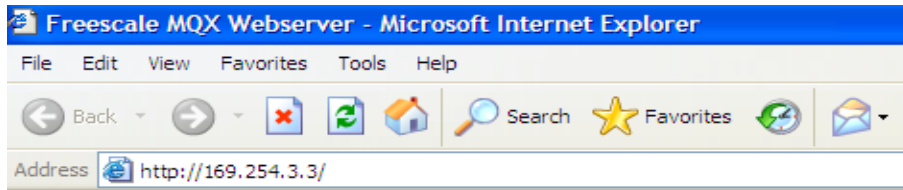
```
codewarrior
File Edit View Favorites Tools Help
Back Forward Up Down Search Folders
Address D:\Program Files\Freescale\Freescale MQX 3.2\demo\security_telnet\codewarrior
Name Size Type Date Modified
sectelnet_twrnmc51cn_Data File Folder 2009-7-24 16:59
sectelnet_twrnmc51cn.mcp 437 KB CodeWarrior Project 2009-7-24 17:00

C:\WINDOWS\system32\cmd.exe - telnet 169.254.3.3
D:\Profiles\b17539>telnet 169.254.3.3
Trying 169.254.3.3...
Connected to 169.254.3.3.
Escape character is '^]'.

Shell (build: Jun 26 2009)
Copyright (c) 2008 Freescale Semiconductor;
shell>
shell> help
Available commands:
    status
    displaylog
    clearlog
    ledon <LED number>
    ledoff <LED number>
    exit
    help [<command>]
    ?
shell> displaylog
Time Since Bootup: 00:04:24
00:04:13 Window closed
00:04:12 Window opened
00:04:10 Door Closed
00:04:10 Door Opened
00:00:00 System Started
shell>
```


Security web server demo

- ▶ Run security web server demo
- ▶ Type 169.254.3.3 in address bar under IE
- ▶ Try press SW2, SW3, tilt board and tune potentiometer and see web page result



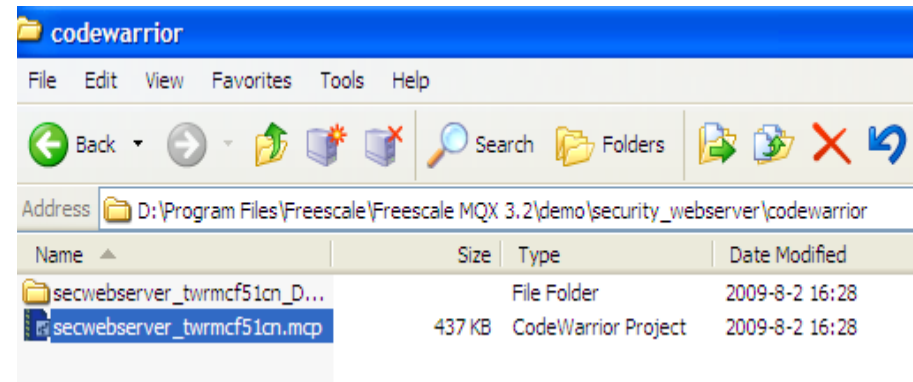
Freescale Semiconductor

Security Status	MCF51CN128 Security Status
MCF51CN128 Information	
Tower System Information	

Door: Closed (SW2)
Window: Closed (SW3)
Motion Detection: No Movement (Accelerometer)
Garage Door: 60% Open (Potentiometer R2)
System Time: 00:00:43

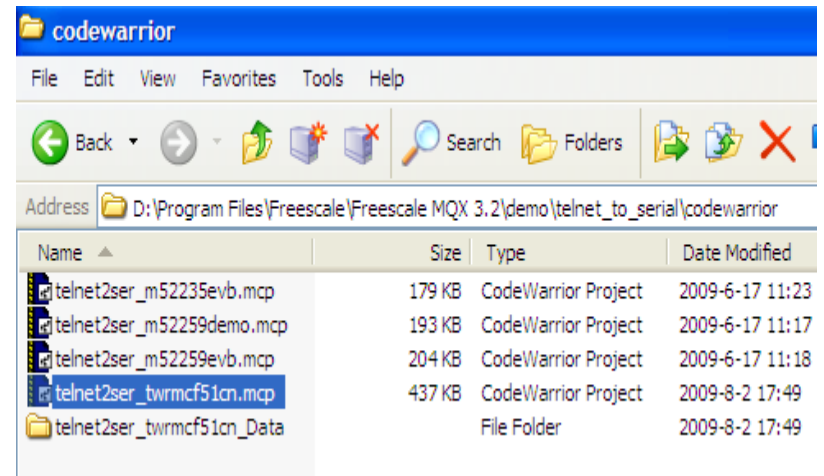
Log:

00:00:39 Motion Stopped
00:00:37 Motion Started
00:00:33 Door Closed
00:00:32 Door Opened
00:00:16 Window closed



Serial to Ethernet bridge

- ▶ Run serial to Ethernet bridge demo
- ▶ Telnet 169.254.3.3, create Hyper-terminal with 115200bps 8N1 setting
- ▶ Type hello in CMD window, then type jeanne in Hyper-terminal window



```
C:\WINDOWS\system32\cmd.exe - telnet 169.254.3.3

D:\Profiles\b17539>telnet 169.254.3.3
Trying 169.254.3.3...
Connected to 169.254.3.3.
Escape character is '^]'.

Ethernet <-> Serial Bridge
jeanne
```

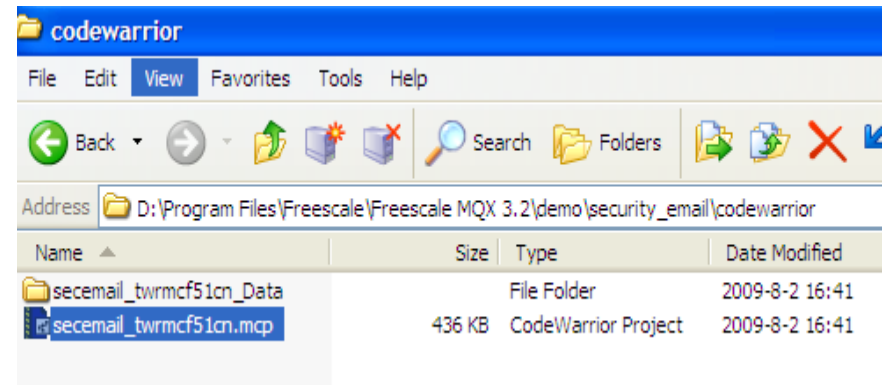
```
Tera Term - COM1 VT

File Edit Setup Control Window Help

Serial <-> Ethernet Bridge
hello
```

Security email demo

- ▶ Run security email demo
- ▶ Connect 51CN demo board on a router in same subnet of your Laptop
- ▶ Configure email server name, user name and password correctly
- ▶ Press SW2 or SW3 and you will be receiving an alert mail in your mailbox



主 题: **Freescale Tower System: Intrusion Alert!** [举报垃圾邮件]
时 间: 2009年8月2日(星期日) 下午17:12
发件人: TWR-MCF51CN-KIT <cutworth@163.com> [查看邮件往来] [拒收]
收件人: Developer <hellojeanne@126.com>

Window was opened on 8/2/2009 at 09:12:20 GMT.

Previous event was on 8/2/2009 at 09:11:18 GMT.

-Freescale Semiconductor

```
#define EMAIL_SERVER "smtp.163.com"
#define EMAIL_TO "hellojeanne@126.com"
#define EMAIL_FROM "cutworth@163.com"

#define AUTH_REQUIRED 0
#define AUTH_USERNAME "username"
#define AUTH_PASSWORD "password"
```

Fill your actual user name and password here!!!

